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Ichikawa

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[54] **BINOCULAR WITH ROTATION TRANSMITTING SYSTEM**

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[*] Notice: This patent is subject to a terminal disclaimer.

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[7] **G02B 23/00**

[52] **U.S. Cl.** **359/416**; 359/412; 359/422

[58] **Field of Search** 359/407, 408, 359/409, 411, 412, 413, 414, 415, 416, 417, 418, 422, 480, 481

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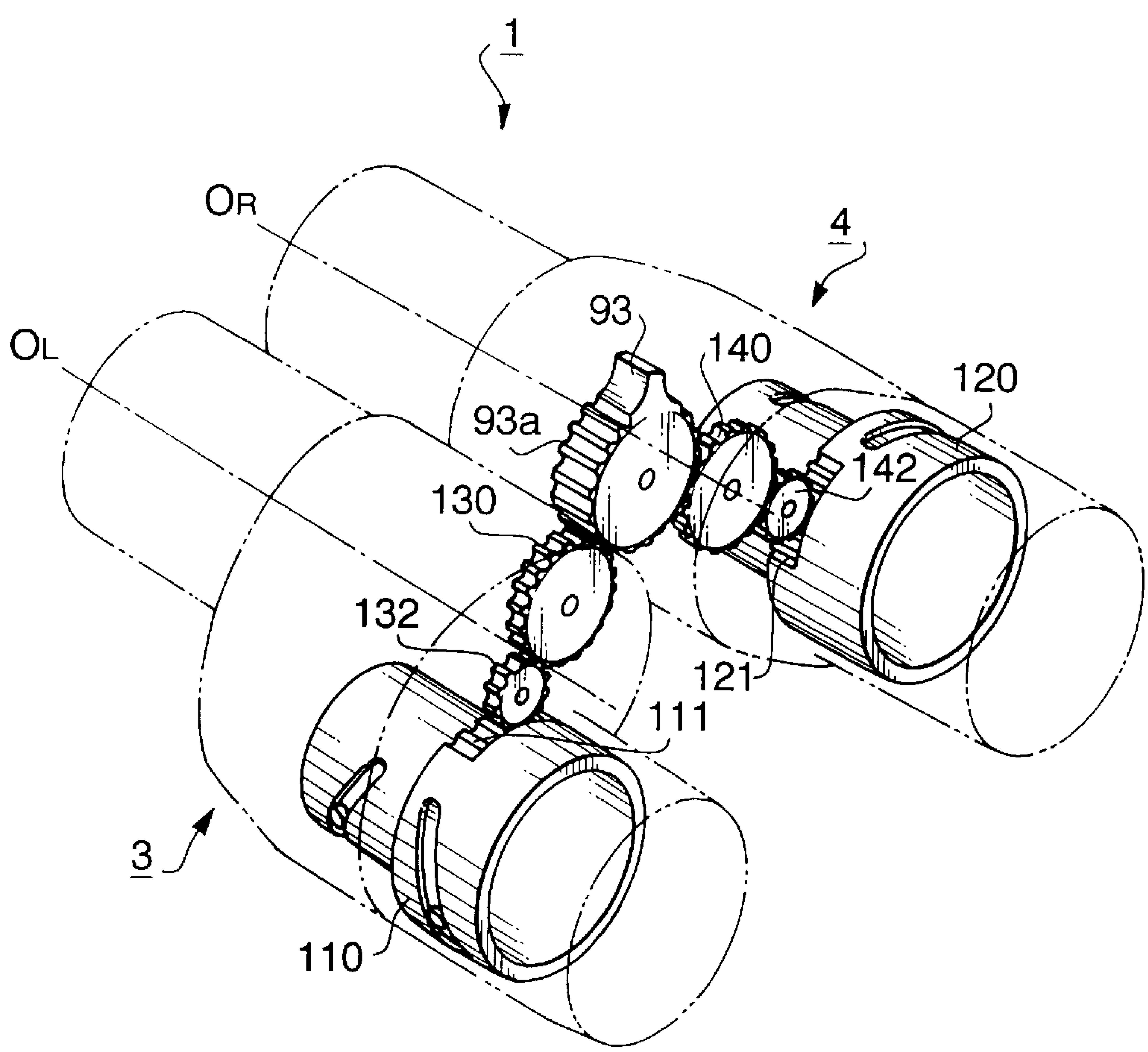
Primary Examiner—Cassandra Spyrou
Assistant Examiner—Mark A. Robinson
Attorney, Agent, or Firm—Greenblum & Bernstein P.L.C.

[57] **ABSTRACT**

A binocular includes two parallel telescope systems two swingable bodies respectively accommodating the telescope systems, a supporting body which swingably supports the swingable bodies so that the swingable bodies are respectively swingable about two parallel swing axes, two drive rings rotatably provided to the swingable bodies, an operation knob provided to the supporting body which, and two rotating bodies respectively linked to the drive rings. Each of the rotating bodies located across a border of the swingable body and the supporting body.

16 Claims, 11 Drawing Sheets



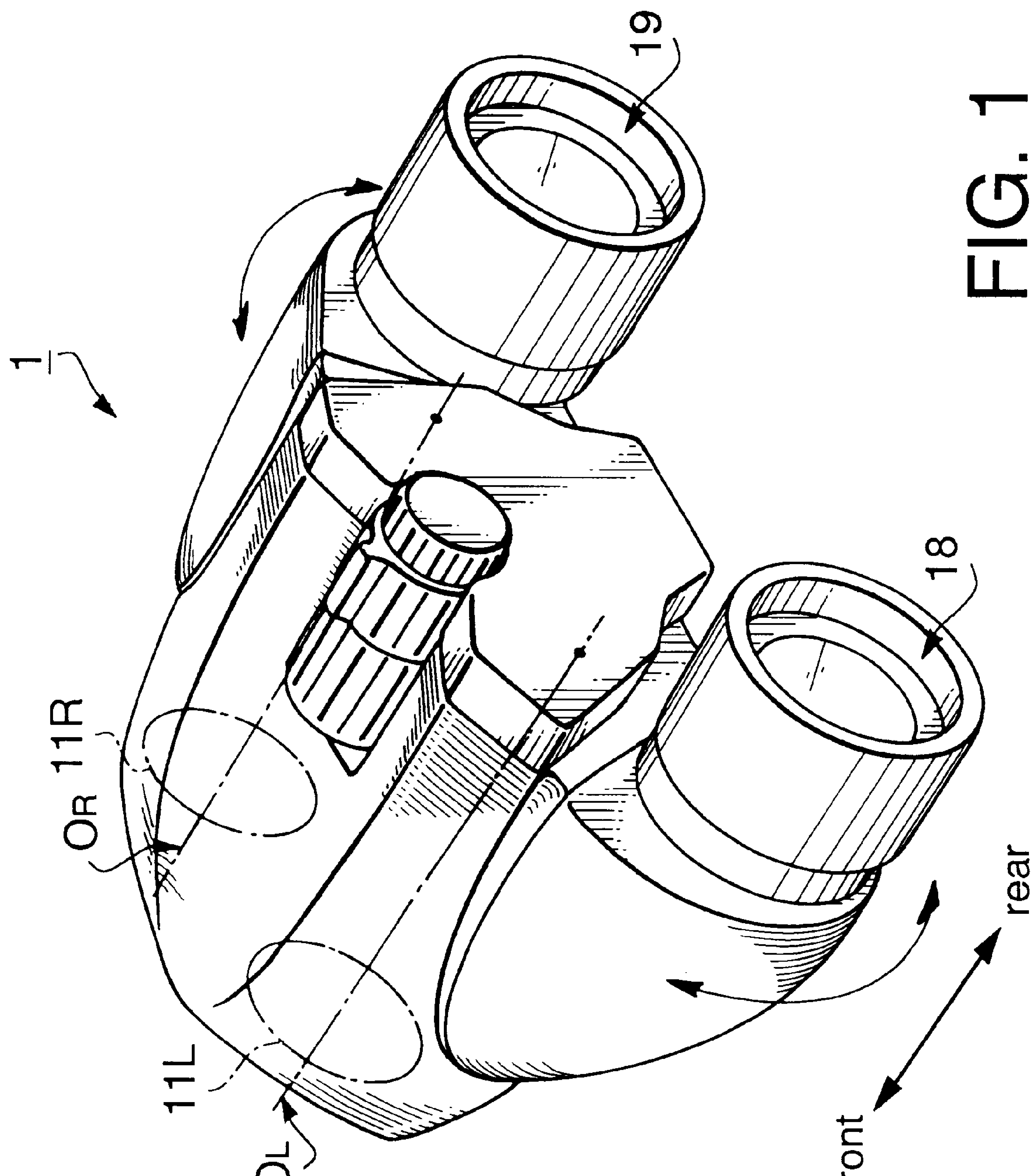
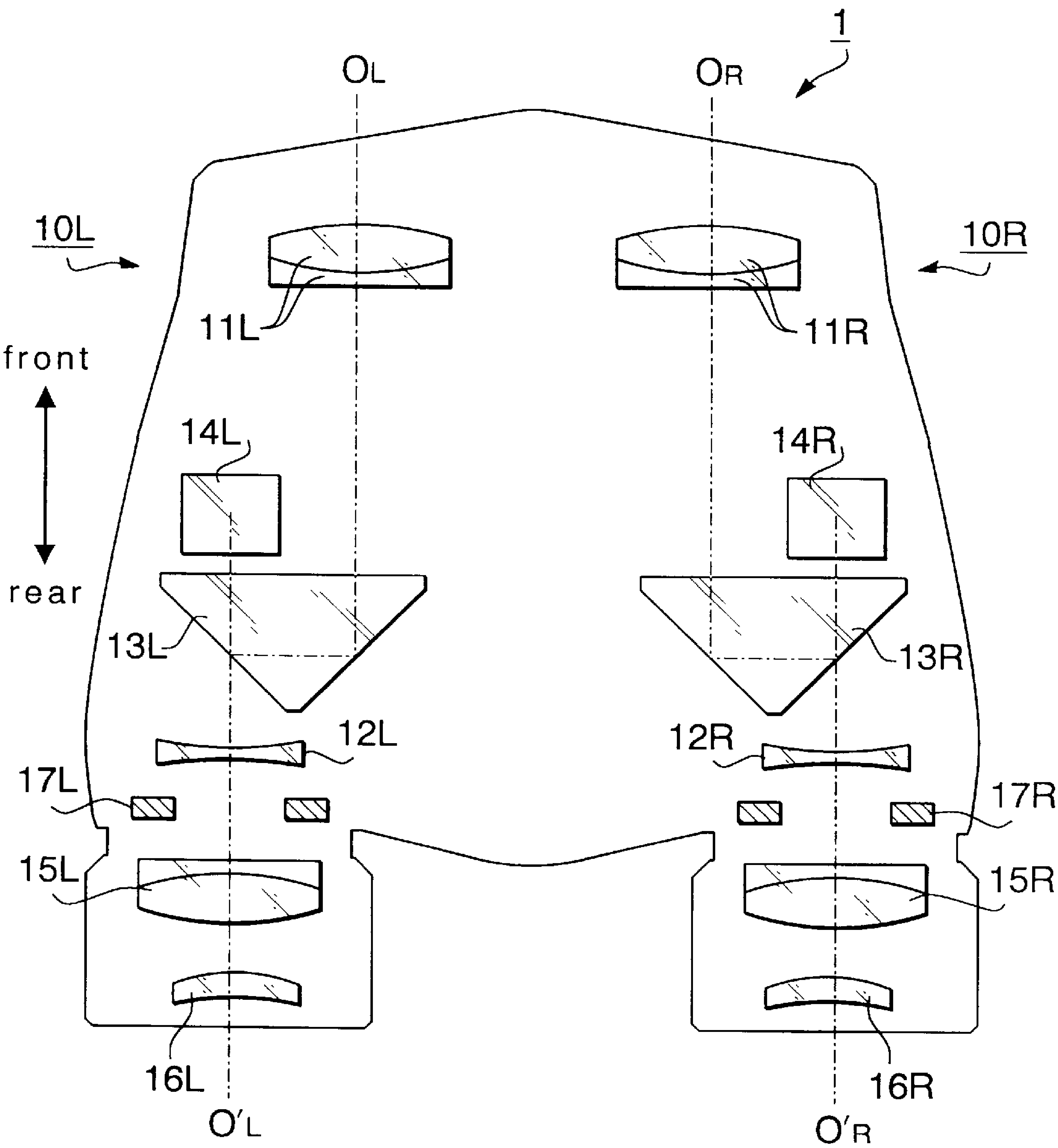
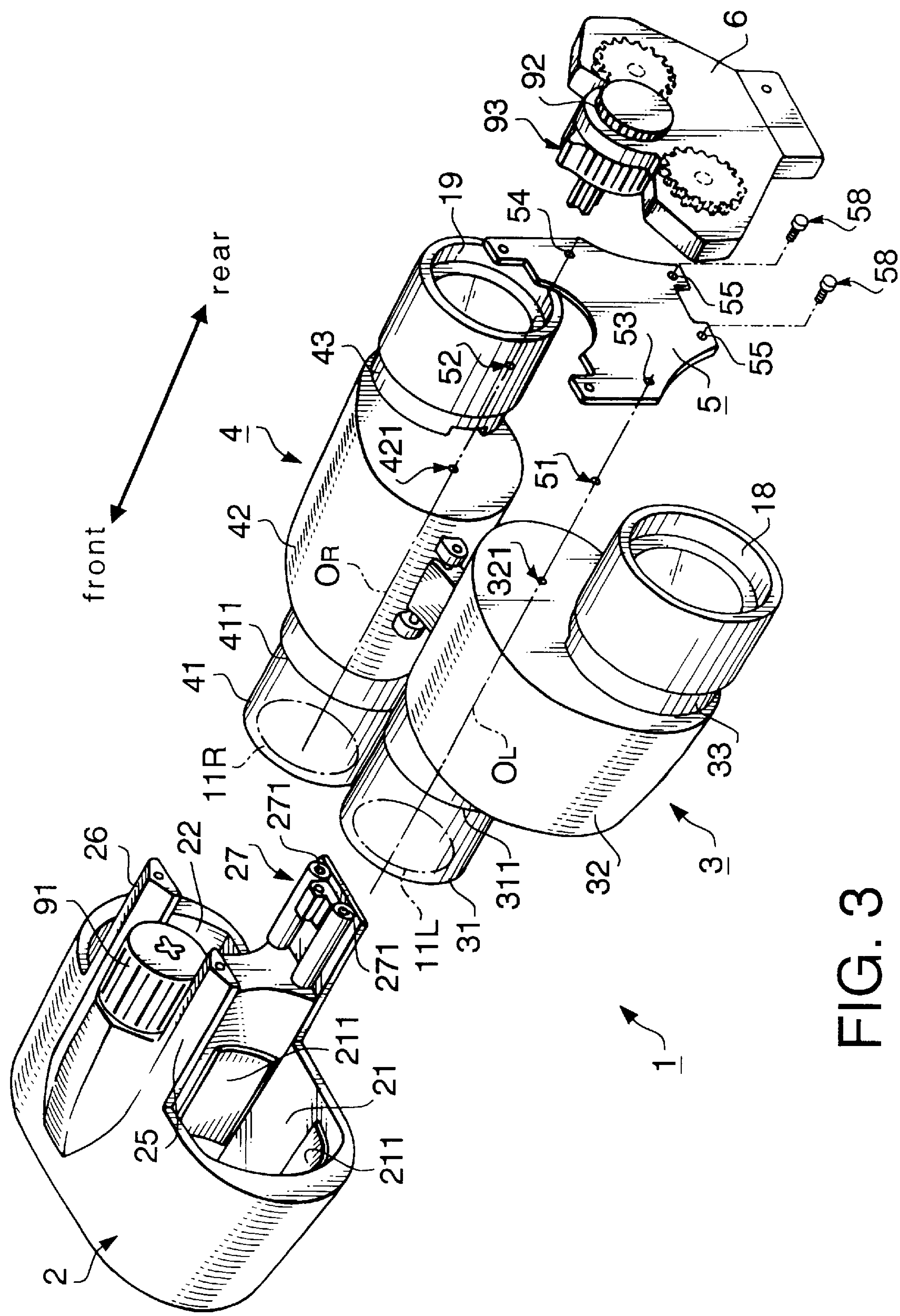


FIG. 1

FIG. 2


1
OL
OR
10L
10R
11L
11R
front
rear
14L
14R
13L
13R
12L
12R
17L
17R
15L
15R
16L
16R
O'L
O'R


front
rear
6
92
93
19
54
58
58
55
55
53
52
43
5
4
421
51
42
OR
321
18
411
41
11R
OL
33
271
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91
271
11L
31
311
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211
21
211
25
1
2

FIG. 3

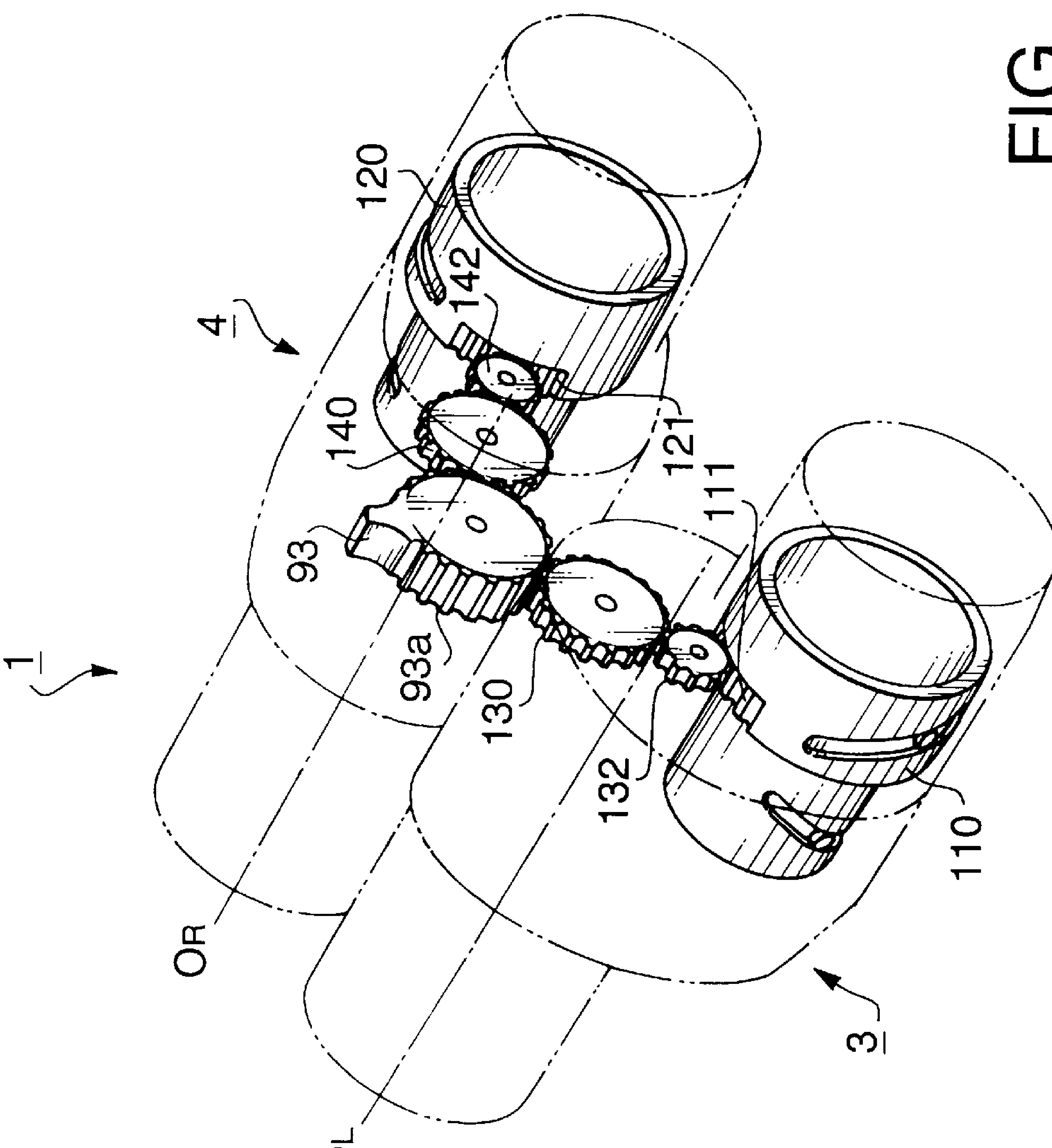


FIG. 4

FIG. 5

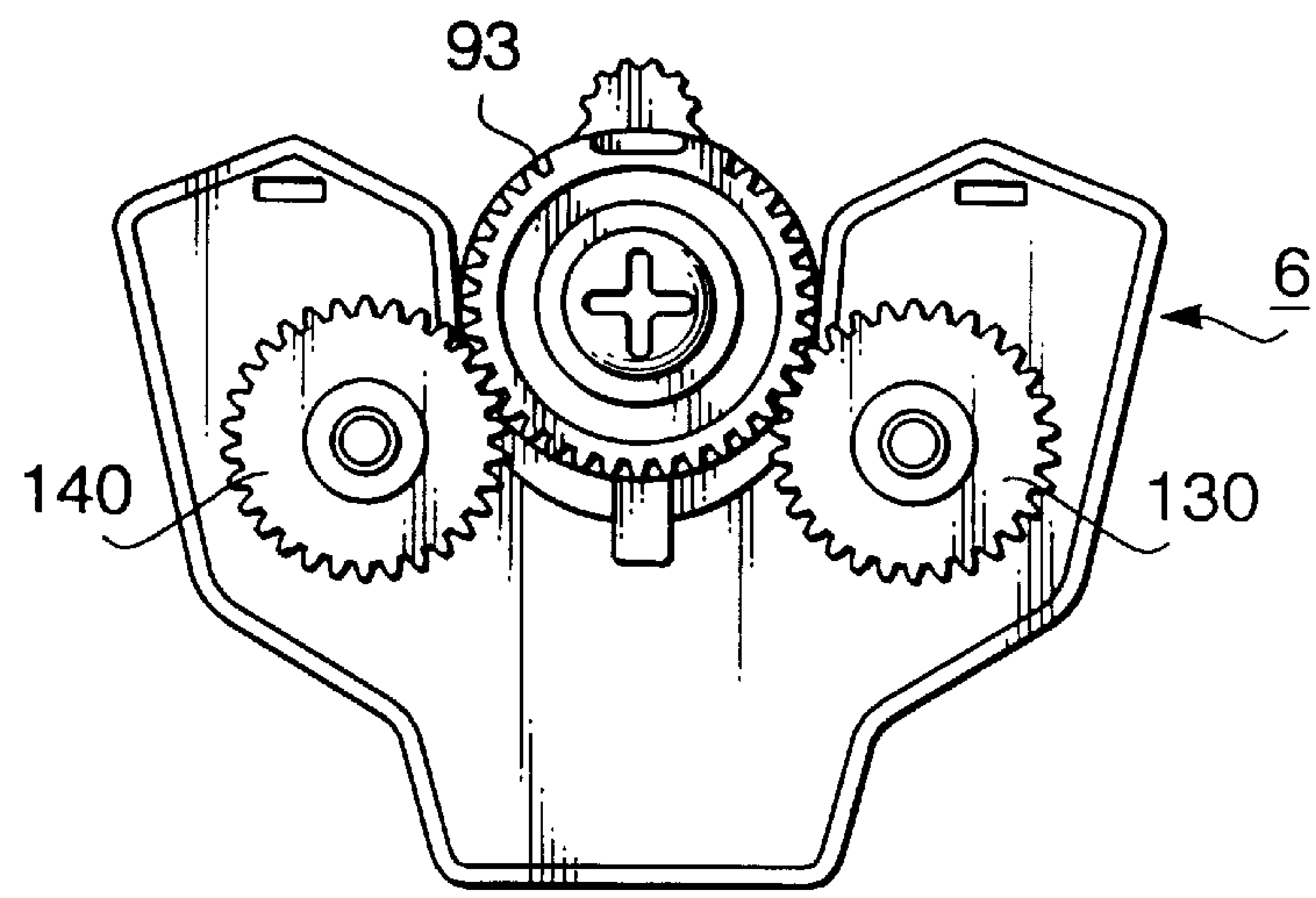


FIG. 6

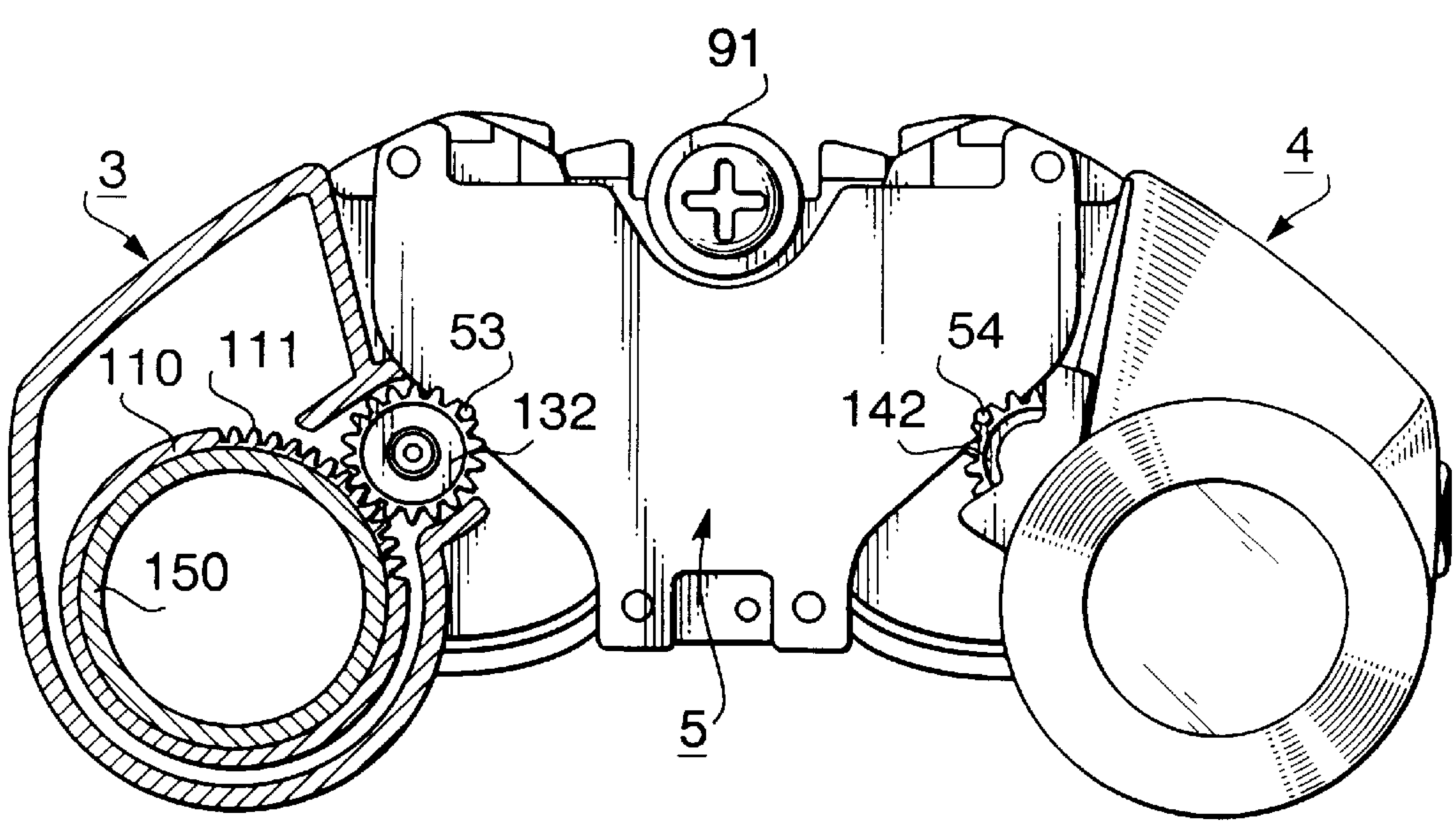


FIG. 7

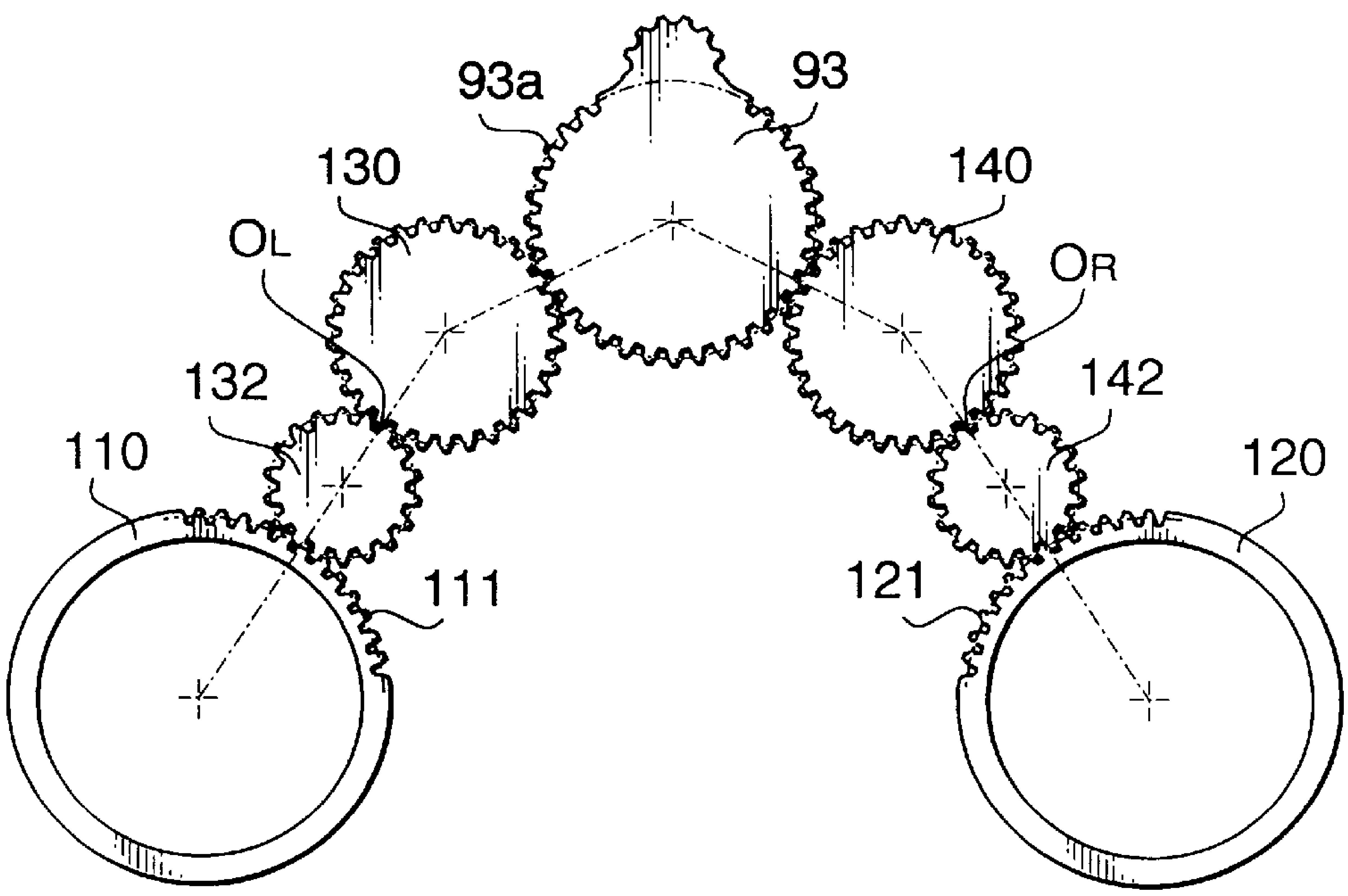

93a
93
130
140
OL
OR
132
142
110
120
111
121

FIG. 8

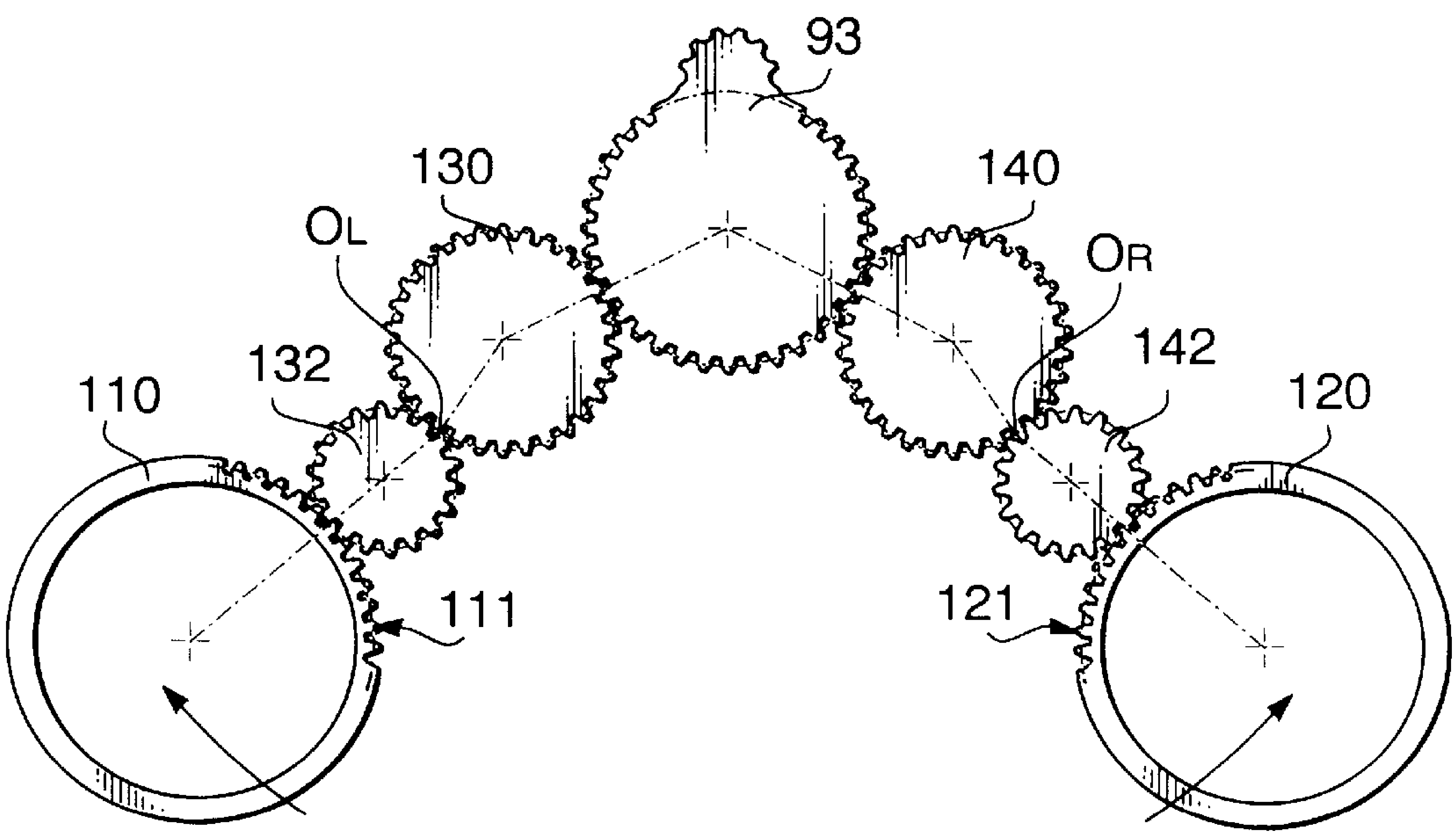

93
130
140
OL
OR
132
142
110
120
111
121

FIG. 9

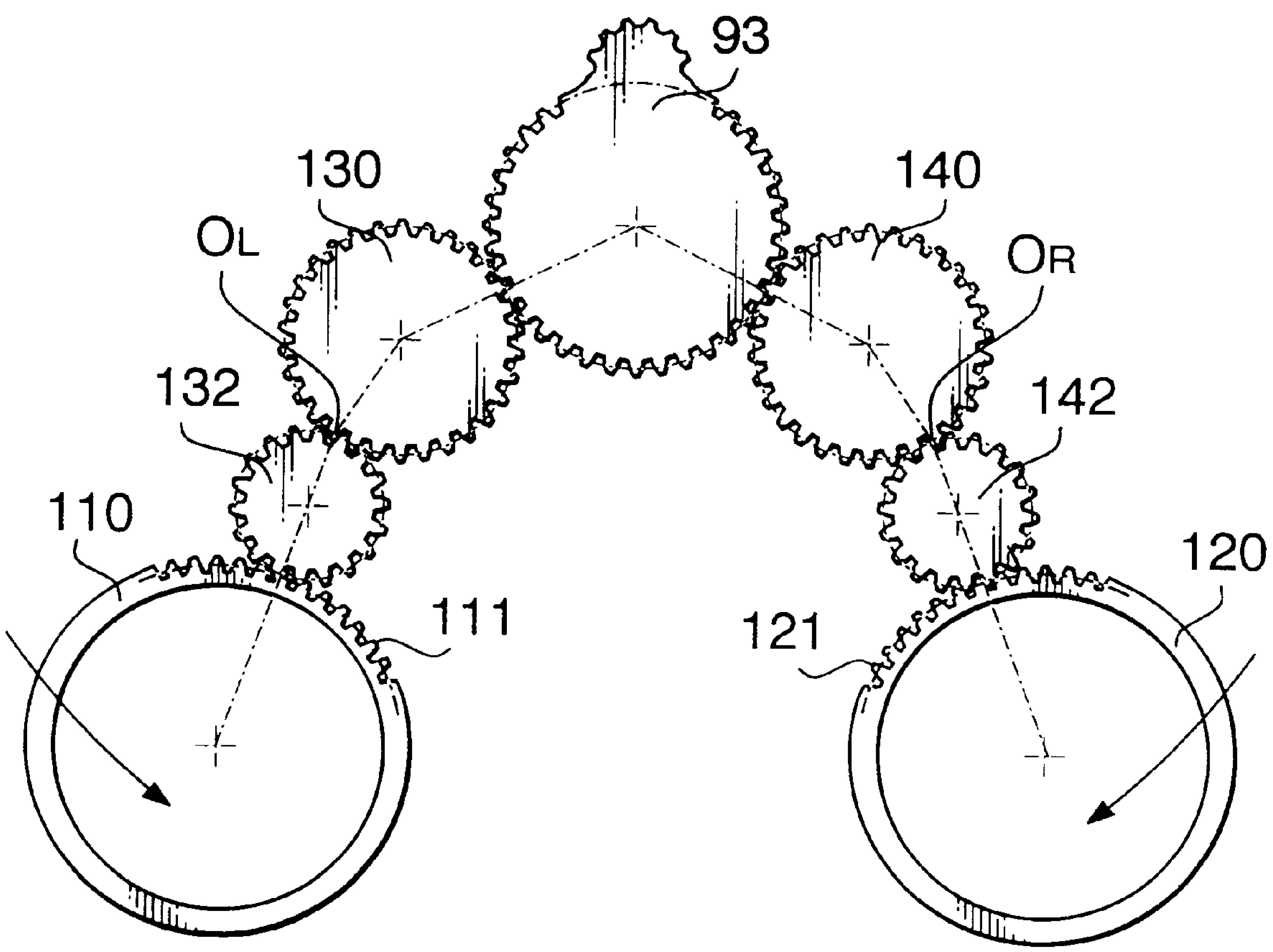


FIG. 10A

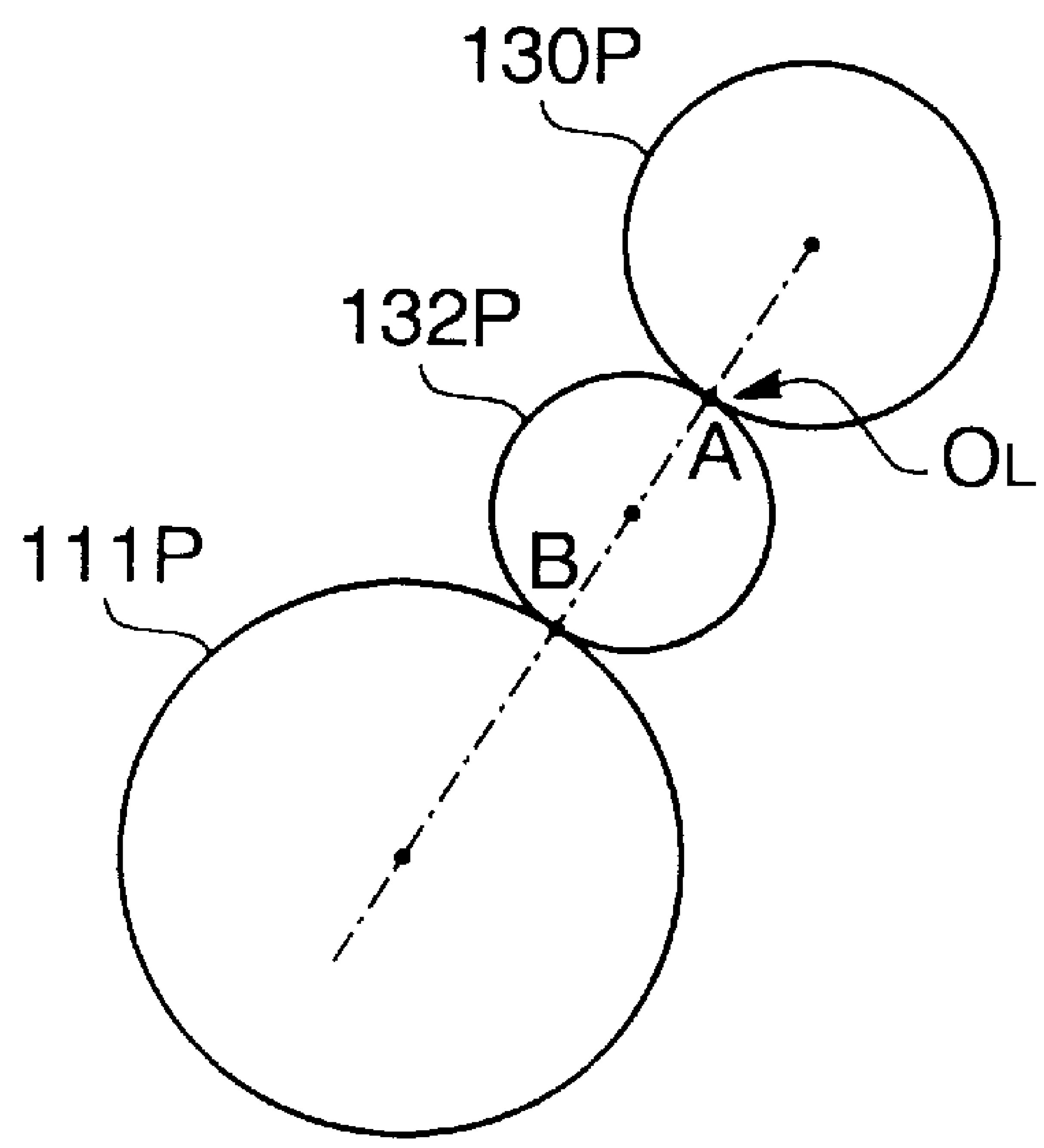


FIG. 10B

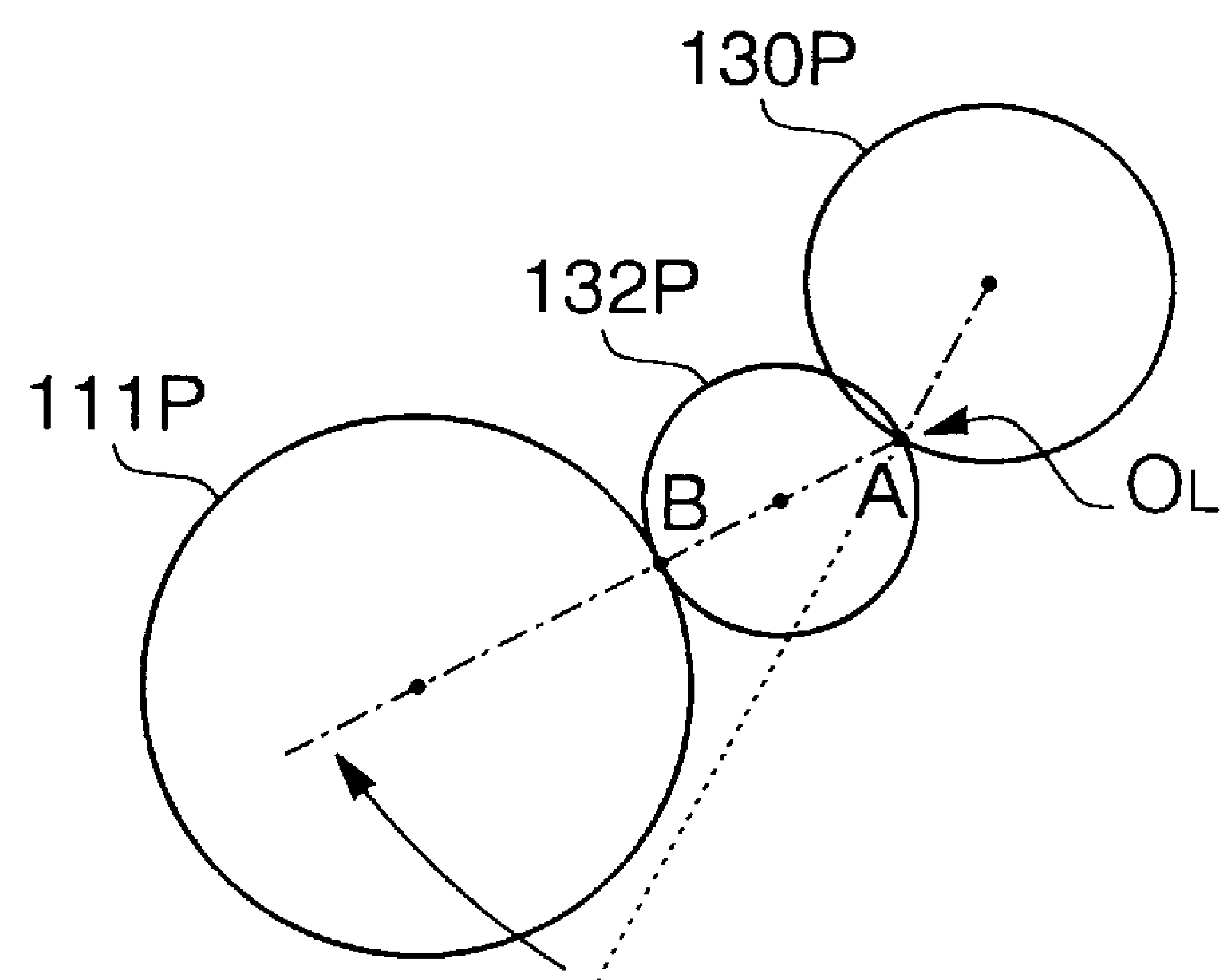


FIG. 10C

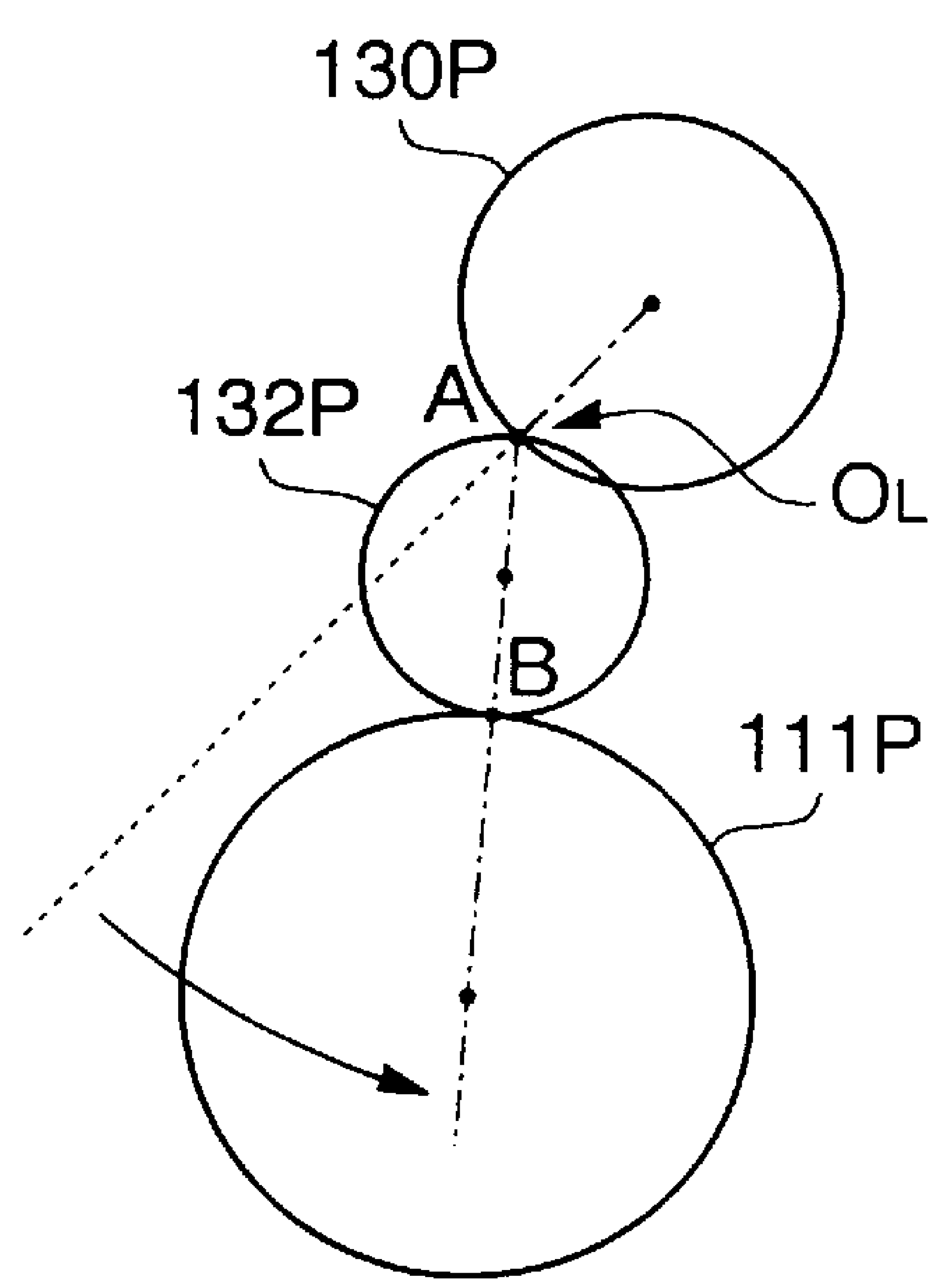


FIG. 11A

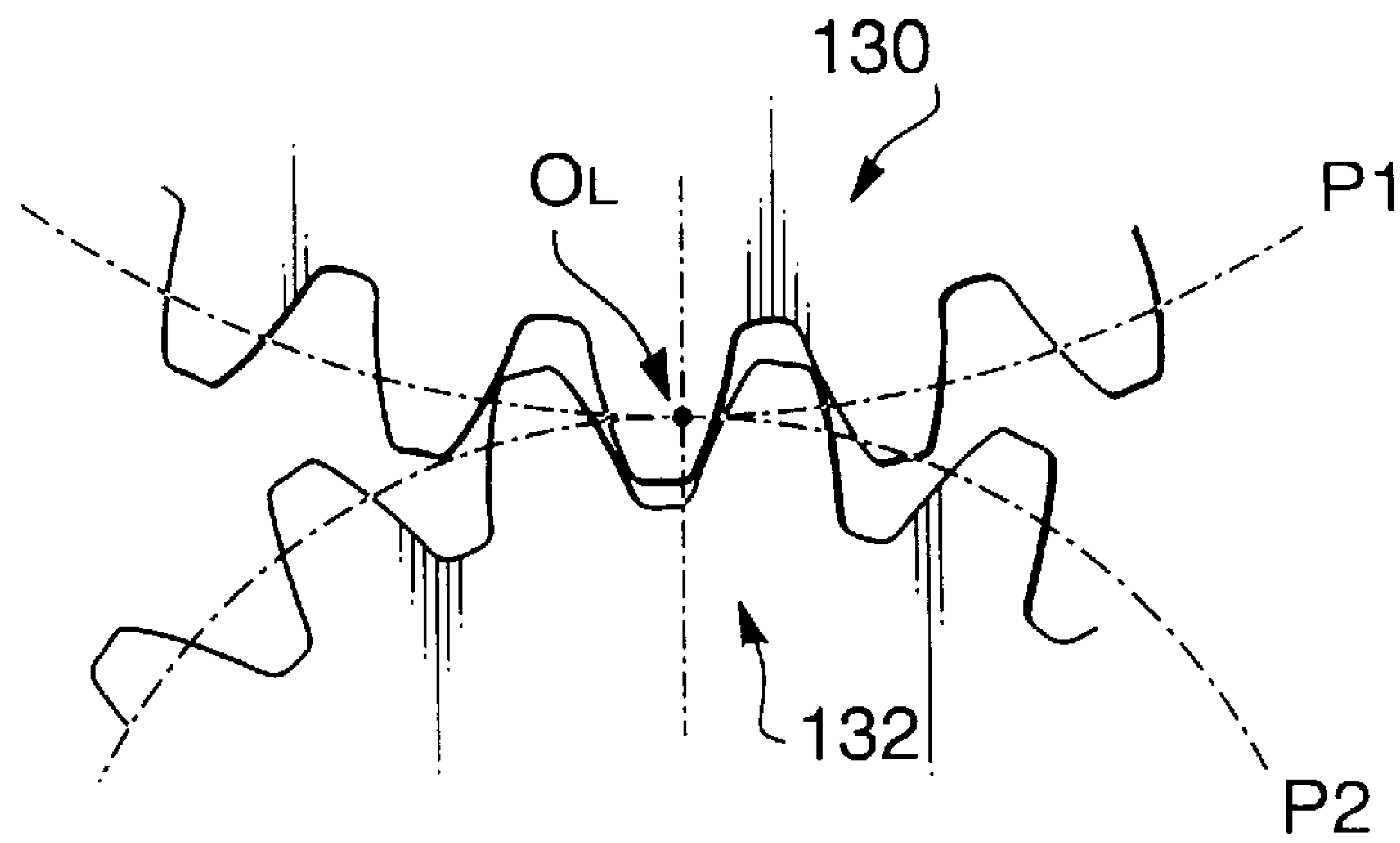


FIG. 11B

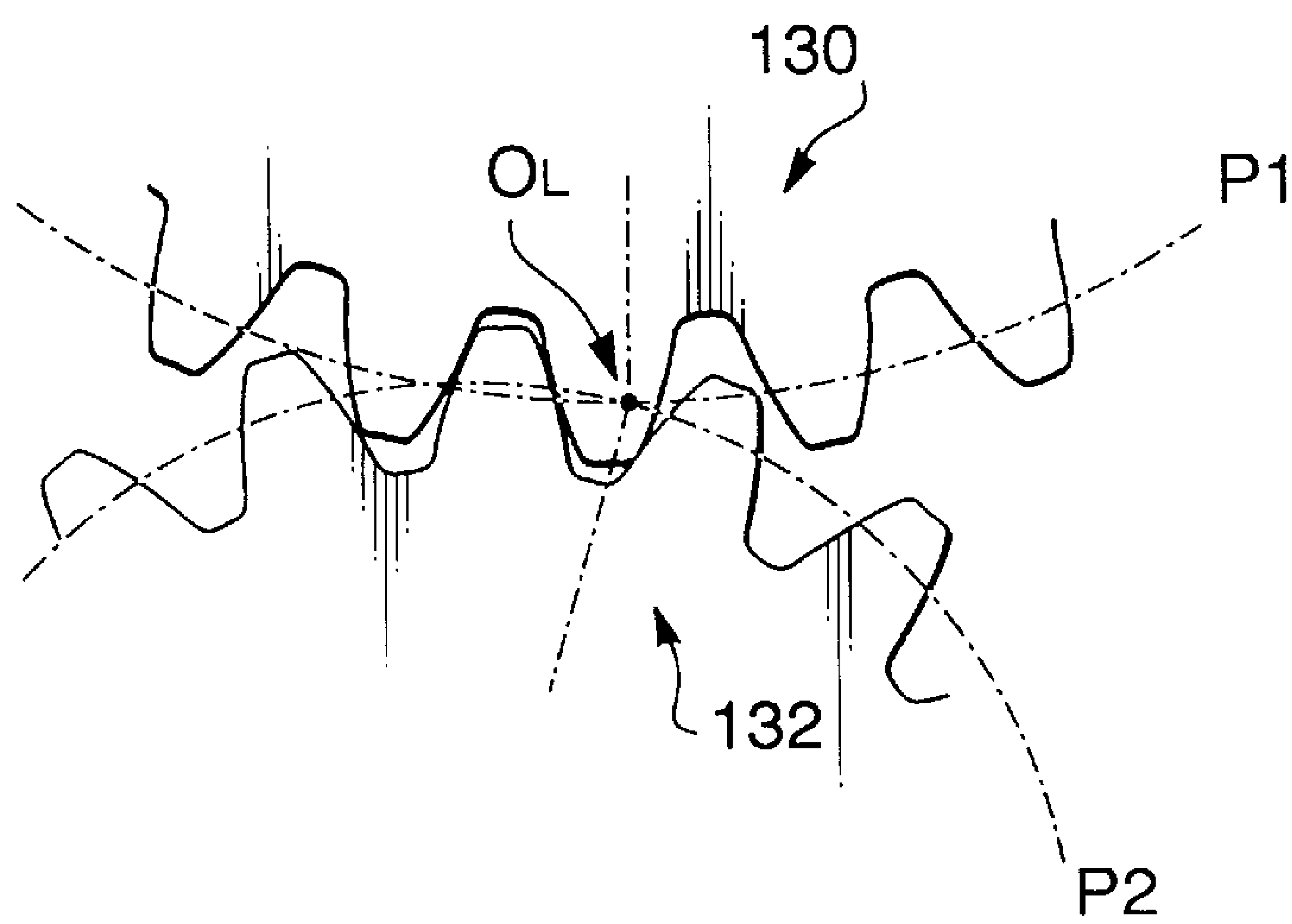


FIG. 11C

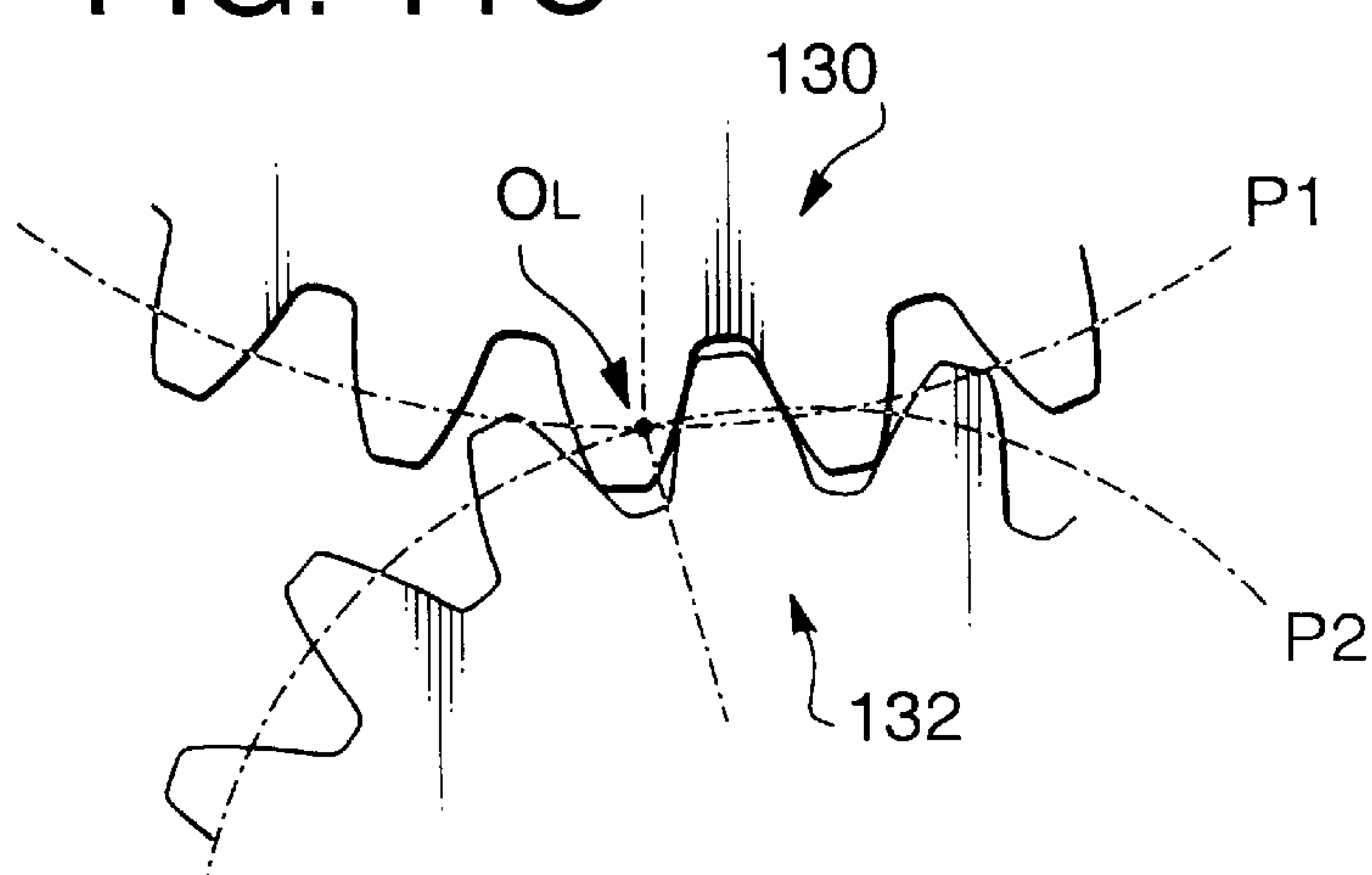


FIG. 12

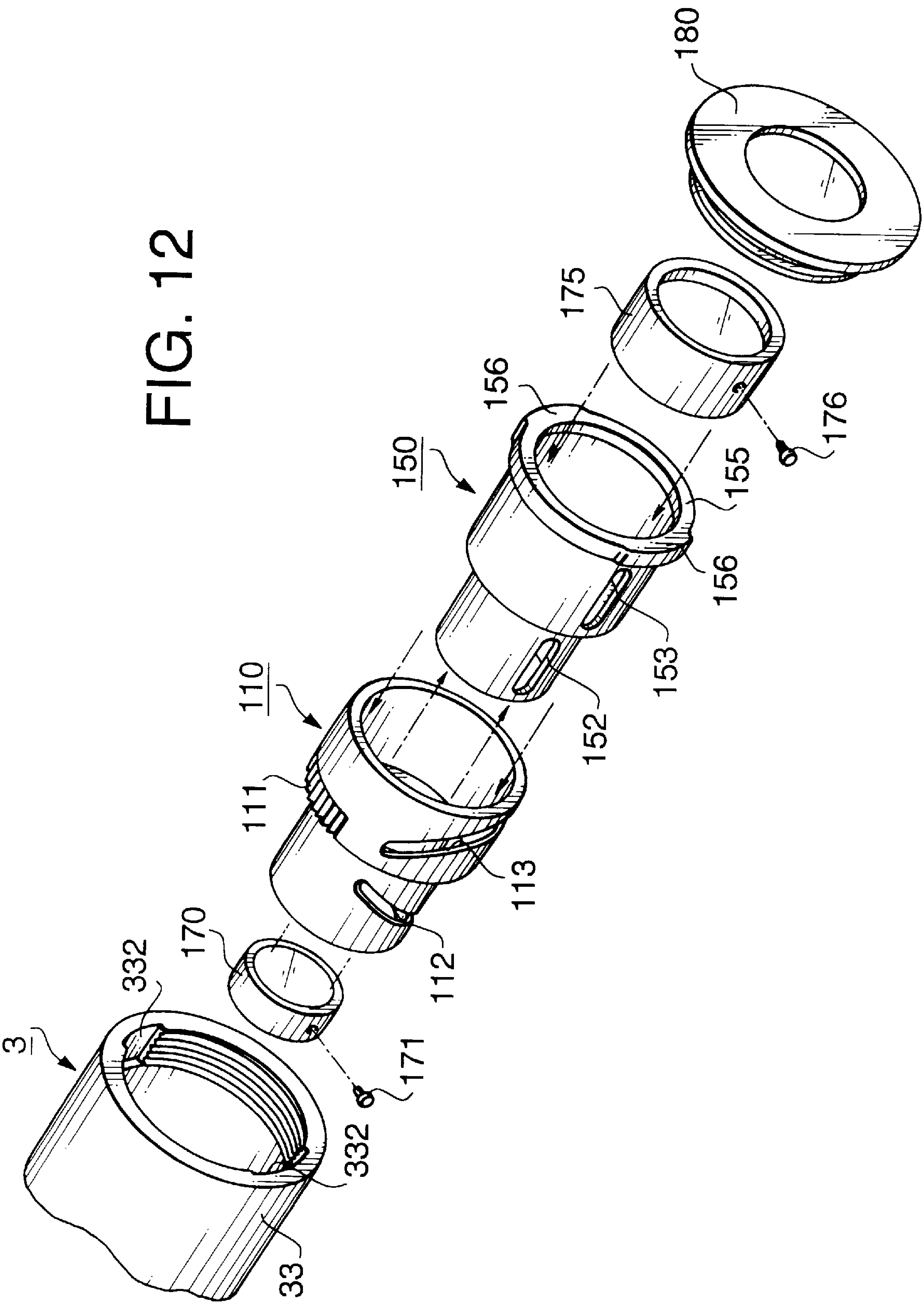

180
175
176
156
150
155
156
153
152
110
111
113
112
170
332
3
171
332
33

FIG. 13A

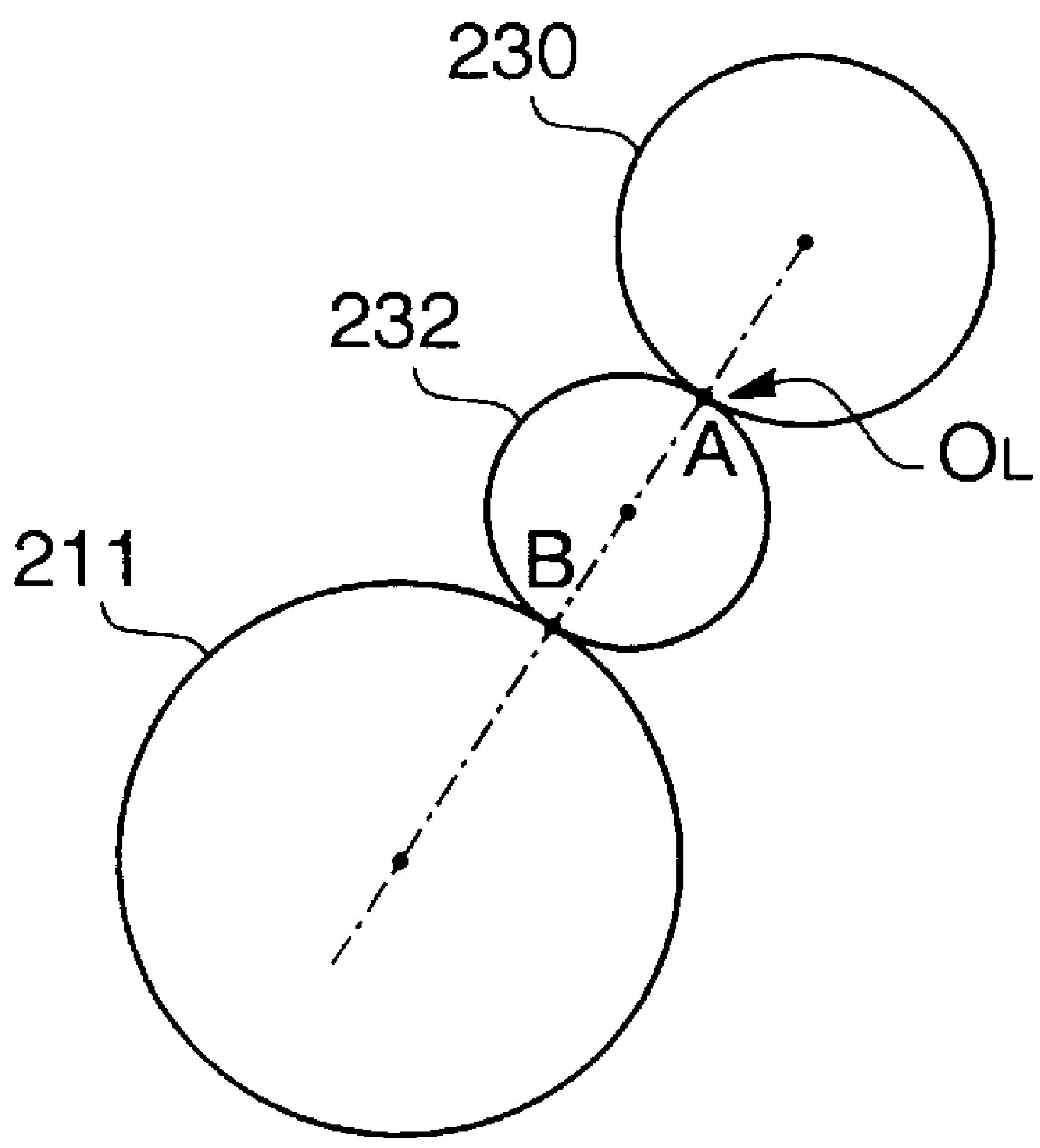


FIG. 13B

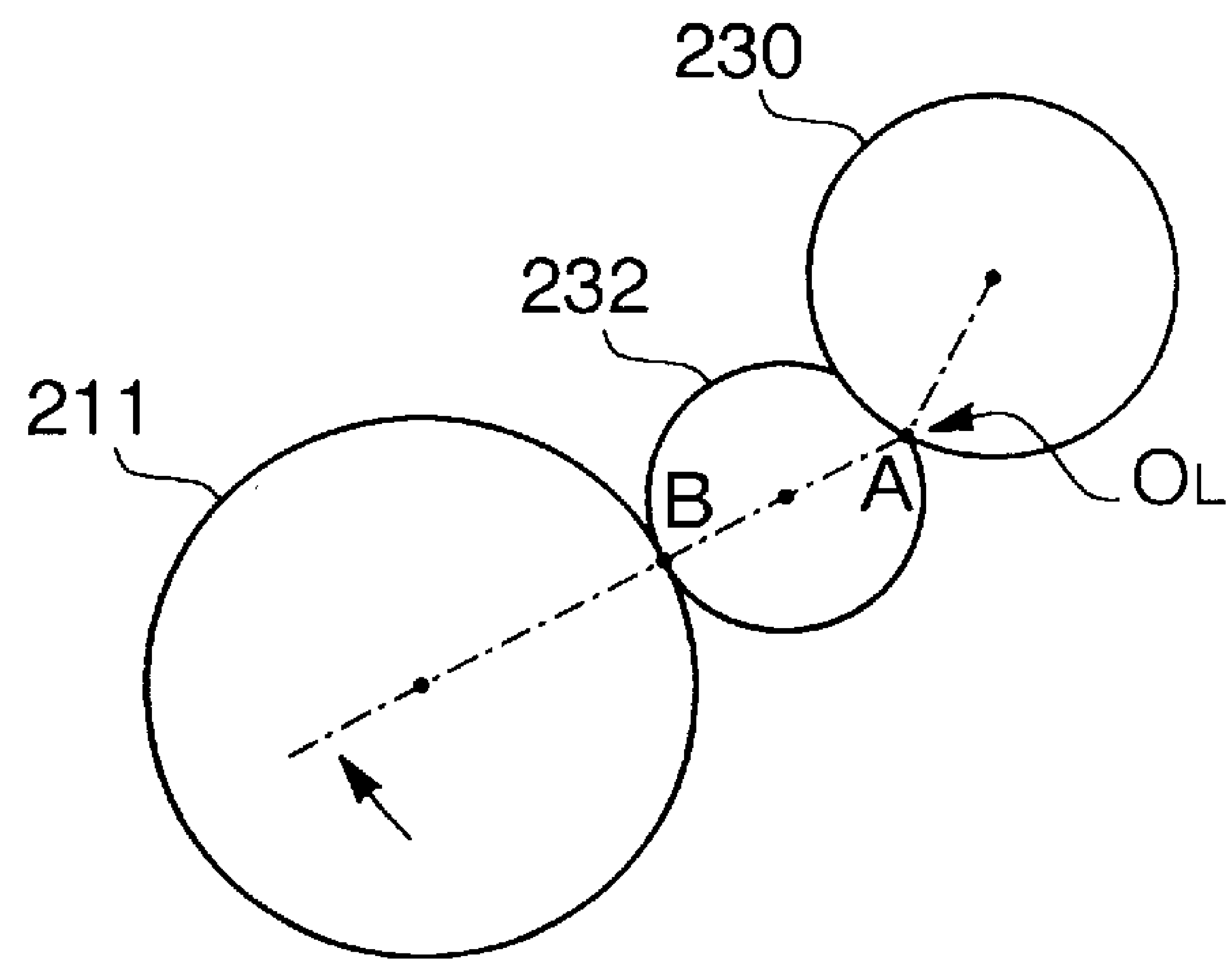
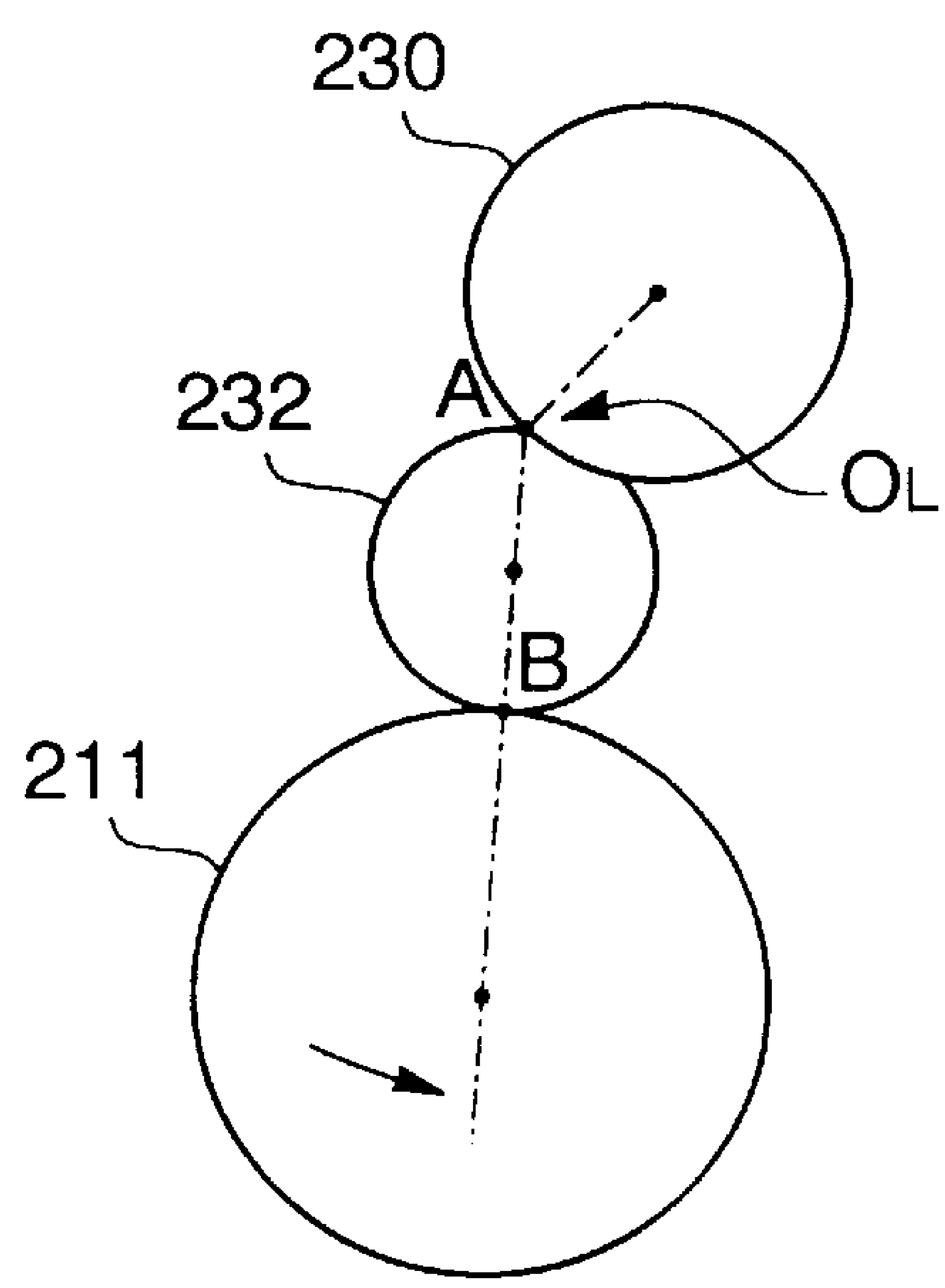


FIG. 13C



BINOCULAR WITH ROTATION TRANSMITTING SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a binocular.

Generally, a binocular includes a mechanism such as a magnifying-power-varying mechanism and an operation knob for manually operating the mechanism. In case of a binocular with the magnifying-power-varying mechanism, two drive rings (for example, cam rings) are provided to left and right lens barrels for moving the lens groups. In order to transmit the rotation of the operation knob to the drive rings, the conventional binocular is provided with a gear train connecting the operation knob and the drive rings.

However, if the binocular further has an interpupillary adjustment mechanism (in which the lens barrels are swung about certain swing axes), the arrangement for transmitting the rotation of the operation knob to the drive rings becomes complicated.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a binocular with an interpupillary adjustment mechanism, which has a simple arrangement for transmitting the rotation of an operation knob to a magnifying-power-varying mechanism or the like.

According to an aspect of the present invention, a binocular includes two parallel telescope systems, two swingable bodies respectively accommodating the telescope systems, a supporting body which swingably supports the swingable bodies so that the swingable bodies are respectively swingable about two parallel swing axes, two drive rings rotatable provided to the swingable bodies, an operation knob provided to the supporting body, and two rotating bodies respectively linked to the drive rings. Each of the rotating bodies located across a border of the swingable body and the supporting body.

With such an arrangement, since the rotating bodies are located across the swingable body and the supporting body, the arrangement for transmitting the rotation of the operation knob to the drive rings becomes simple.

In a particular arrangement, each of the telescope systems has an object system and an eyepiece system, an eyepiece optical axis of the eyepiece system being parallel but off-centered with an object optical axis of a front-most lens of the object system. Further, the swingable body includes a front barrel accommodating the front-most lens, a rear barrel accommodating at least the eyepiece system. The front and rear barrels are parallel but off-centered with each other. An intermediate barrel is provided between the front and rear barrels. In this case, the rotating body is provided to the rear barrel so that the rotating body projects from the rear barrel.

As constructed above, the operation knob and the drive rings (provided in the rear barrels) can be mechanically connected in a simple structure.

In particular, it is possible that the supporting body include a front support which supports two front barrels, and a rear support which supports two intermediate barrels. The operation knob is provided to the rear support.

It is preferable that two middle bodies are rotatably provided to the supporting body in such a manner that said middle bodies respectively engage with the rotating bodies. Each middle body is provided between the operation knob and the drive ring. In this case, the engaging position of the middle body and the rotating body is located on the swing

axis. Further,. With this, the interpupillary adjustment does not affect the rotation of the drive rings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of binocular according to an embodiment of the present invention;

FIG. **2** is a schematic view showing an optical system of the binocular of FIG. **1**;

FIG. **3** is an exploded perspective view of the binocular of FIG. **1**;

FIG. **4** is a perspective view illustrating an arrangement for varying magnifying-power;

FIG. **5** is a front view of a rear cover;

FIG. **6** is a rear view of swingable bodies and a rear support;

FIG. **7** is a rear view illustrating the engagement of gears when the interpupillary is intermediate;

FIG. **8** is a rear view illustrating the engagement of gears when the interpupillary is maximum;

FIG. **9** is a rear view illustrating the engagement of gears when the interpupillary is minimum;

FIGS. **10**A, **10**B and **10**C are schematic views respectively illustrating the relationship of pitch circles of the gears of FIGS. **7**, **8** and **9**;

FIGS. **11**A, **11**B and **11**C are enlarged views respectively illustrating the engaging portion of the gears of FIGS. **7**, **8** and **9**;

FIG. **12** is an exploded perspective view of an arrangement in which a cam ring moves lenses; and

FIG. **13**A, **13**B and **13**C are schematic views illustrating rollers of the second embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is described with reference to the preferred embodiment thereof.

FIG. **1** is a perspective view showing an external view of a binocular **1** according to the embodiment. FIG. **2** shows optical systems of the binocular **1**. As shown in FIG. **2**, the binocular **1** includes left and right telescope systems **10**L and **10**R. Since the telescope syatsem **10**L and **10**R are symmetrical with each other, the description will deal with the left telescope system **10**L and the corresponding reference numbers for the right telescope system **10**R will be shown in brackets.

The telescope system **10**L (**10**R) includes first lens **11**L (**11**R), porro prisms **13**L and **14**L (**13**R and **14**R), second lens **12**L (**12**R), third lens **15**L (**15**R) and fourth lens **16**L (**16**R). The first lens **11**L (**11**R) and the second lens **12**L (**12**R) constitute an objective system. The third lens **15**L (**15**R) and the fourth lens **16**L (**16**R) constitute an eyepiece system. The porro prisms **13**L and **14**L (**13**R and **14**R) constitute an erecting system. A field stop **17**L (**17**R) is disposed where an image is formed by the objective system. Eyepiece optical axes O'L and O'R of the left and right eyepiece systems are respectively parallel but off-centered with object optical axes OL and OR of the first lenses **11**L and **11**R. Hereinafter, an objective side of the binocular **1** is referred to as ‘front’, while an eyepiece side of the binocular **1** is referred to as ‘rear’.

FIG. **3** is an exploded perspective view of the binocular **1**. The binocular **1** includes left and right swingable bodies **3** and **4** respectively accommodating the left and right telescope systems **10**L and **10**R (FIG. **2**). The left swingable body **3** includes a front barrel **31** and a rear barrel **33** which are parallel but off-centered with each other. An intermediate barrel **32** is provided between the front and rear barrels **31** and **33**. The first lens **11**L (FIG. **2**) is accommodated in the front barrel **31**. The second lens **12**L and the prisms **13**L and **14**L (FIG. **2**) are accommodated in the intermediate barrel **32**. The third and fourth lenses **15**L and **16**L (FIG. **2**) are accommodated in the rear barrel **33**. The rear end of the rear barrel **33** constitutes a left eyepiece portion **18**.

Similarly, the right swingable body **4** includes a front barrel **41**, a rear barrel **43** and an intermediate barrel **42**. The first lens **11**R (FIG. **2**) is accommodated in the front barrel **41**. The second lens **12**R and the prisms **13**R and **14**R (FIG. **2**) are accommodated in the intermediate barrel **42**. The third and fourth lenses **15**R and **16**R (FIG. **2**) are accommodated in the rear barrel **43**. The rear end of the rear barrel **43** constitutes a right eyepiece portion **19**.

In order to swingably support the left and right swingable bodies **3** and **4**, the binocular **1** is further provided with a front support **2** and a rear support **5**. The front support **2** is provided with two bores **21** and **22**. The front barrels **31** and **41** have cylindrical shapes and are fit into the bores **21** and **22**. The rear support **5** is a plate member which supports the rear end of the intermediate barrels **32** and **42** via balls **51** and **52** (respectively positioned on the object optical axes OL and OR). The rear support **5** has holes **53** and **54** positioned on the object optical axes OL and OR. Further, recesses **321** and **421** are formed on the rear ends of the intermediate barrels **32** and **42** and on the object optical axes OL and OR. The balls **51** and **52** are supported (on the object optical axes OL and OR) by the holes **53** and **54** and by the recesses **321** and **421**. An extending portion **27** is extended rearward from the bottom of the front support **2**. The extending portion **27** is provided with two screw holes **271** at the rear end thereof. The rear support **5** is provided with two through-holes **55** positioned corresponding to the screw holes **271**. By inserting two screws **58** through the through-holes **55** of the rear support **5** and by engaging the screws **58** into screw holes **271** of the extending portion **27**, the left and right swingable bodies **3** and **4** are sandwiched by the front and rear supports **5** and **6** and supported in such a manner that the swingable bodies **3** and **4** are respectively swingable about the object optical axes OL and OR.

The swingable bodies **3** and **4** have shoulder portions **311** and **411** which abut abutting portions **211** and **221** formed in the bore **21** and **22** (the right abutting portion **221** is not shown). Since the swingable bodies **3** and **4** are urged by the rear support **5** against the front support **2**, the positions (in the direction parallel to the object optical axes OL and OR) of the swingable bodies **3** and **4** are determined.

The binocular **1** is so constituted that the focus adjustment is performed by moving the left and right first lenses **11**L and **11**R along the object optical axes OL and OR, while the diopter correction is performed by moving the right first lens **11**R along the object optical axis OR. A focus adjusting knob **91** is disposed at the top center of the front support **2**, which is to be operated for focus adjustment. A rear cover **6** is provided to the rear support **5**, on which a diopter correction knob **92** is disposed. The description of the arrangement for the focus adjustment and the diopter correction is omitted.

The arrangement for varying magnifying-power is described. The binocular **1** is so constituted as to vary the magnifying-power thereof by moving the second lenses **12**L and **12**R and the third lens **15**L and **15**R in the direction parallel to the object optical axes OL and OR.

FIG. **4** is a perspective view illustrating the arrangement for varying magnifying-power. A left cam ring **110** is provided in the slidable body **3**, for moving the second lens **12**L and the third lens **15**L (FIG. **2**). A right cam ring **120** is provided in the slidable body **4**, for moving the second lens **12**R and the third lens **15**R (FIG. **2**). The left and right cam rings **110** and **120** are operated by a magnifying-power-varying knob **93** located at a top center of the binocular **1**. In order to transmit a rotation of the magnifying-power-varying knob **93** to the left cam ring **110**, a left first gear **130** and a left second gear **132** are provided between the magnifying-power-varying knob **93** and the left cam ring **110**. Similarly, a right first gear **140** and a right second gear **142** are provided between the magnifying-power-varying knob **93** and the right cam ring **120**. The left and right first gears **130** and **132** engage a peripheral gear **93***a* formed on the periphery of the magnifying-power-varying knob **93**. The left and right second gears **132** and **142** respectively engage peripheral gears **111** and **121** formed on the periphery of the cam rings **110** and **120**. With such an arrangement, if the magnifying-power-varying knob **93** is rotated, the cam rings **110** and **120** are synchronously rotated.

The engaging position on which the left first gear **130** and left second gear **132** engage with each other is located on the left object optical axis OL (that is, the swing axis of the left swingable body **3**). Similarly, the engaging position on which the right first gear **140** and right second gear **142** engage with each other is located on the right object optical axis OR (that is, the swing axis of the right swingable body **4**).

FIG. **5** is a front view of the rear cover **6**. FIG. **6** us a rear view of the swingable bodies **3** and **4** and the rear support **5**. As shown in FIG. **5**, the magnifying-power-varying knob **93** and the first gears **130** and **140** are provided to the rear cover **6**. As shown in FIG. **6**, the second gears **132** and **142** are provided in the swingable bodies **3** and **4** so that the second gears **132** and **142** are partially protruded to the exterior of the swingable body **3** and **4**. When the rear cover **6** is mounted to the rear support **5**, the first gears **130** and **140** respectively come in engagement with second gears **132** and **142**.

The relationship between the magnifying-power-varying mechanism and the interpupillary adjustment is described. FIGS. **7**, **8** and **9** show the engagement of the gears of the magnifying-power-varying mechanism when the interpupillary distance is intermediate, maximum and minimum. When the interpupillary distance is intermediate as shown in FIG. **7**, a line connecting the centers of the left first gear **130** and the left second gear **132** and intersecting the swing axis (shown by the left object axis OL) is straight. When the interpupillary distance is maximum as shown in FIG. **8**, the left second gear **132** and the left cam ring **110** are swung outward about the left object optical axis OL. When the interpupillary is minimum as shown in FIG. **9**, the left second gear **132** and the left cam ring **110** are swung inward about the left object optical axis OL. The right second gear **142** and the right cam ring **120** are swung in a symmetrical manner with respective to the left second gear **142** and the left cam ring **110**.

FIGS. **10**A, **10**B and **10**C are schematic views illustrating the relationship of pitch circles **130**P, **132**P and **111**P of the left first gear **130**, the left second gear **132** and the left sector gear **111** (of the left cam ring **110**). FIGS. **10**A, **10**B and **10**C respectively correspond to the FIGS. **7**, **8** and **9**. In FIG. **10**A, a point A is defined on the pitch circle **132**P so that the point A contacts the pitch circle **130**P when the intermediate distance is intermediate. The point A is positioned on the swing axis (shown by the object optical axis OL). Further, a point B is defined on the pitch circle **130**P so the point B is opposite to the point A with respect to the center of the pitch circle **132**P. In FIG. **10**A, the point B contacts the pitch circle **111**P. When the pitch circles **132**P and **111**P are swung about the swing axis as shown in FIG. **10**B, the pitch circles **130**P and **132**P intersect with each other on two points (one of which is the above-defined point A). This is possible due to the existence of the backlash between the first gear **130** and the second gear **132** as described below. Since the point A corresponds to the swing axis, the point B still contacts the pitch circle **111**P as shown in FIG. **10**B. Thus, the relationship between the left second gear **132** and the left sector gear **111** in FIG. **10**B is the same as that of FIG. **10**A. In other word, engaging gear tooth of the left second gear **132** and the left sector gear **111** in FIG. **10**B are same as that of FIG. **10**A. Similarly, when the pitch circles **132**P and **111**P are swung as shown in FIG. **10**C, the relationship between the left second gear **132** and the left sector gear **111** is the same as that of FIG. **10**A.

Accordingly, the left sector gear **111** (of the left cam ring **110**) is not rotated by the left second gear **132** by when the interpupillary adjustment is performed. Similarly, the right sector gear **121** (of the right cam ring **120**) is not rotated by the right second gear **142** when the interpupillary adjustment is performed.

The engagement of the gears of the magnifying-power-varying mechanism is detailed with respect to the FIGS. **11**A, **11**B and **11**C. FIGS. **11**A, **11**B and **11**C are enlarged views illustrating the area of the engagement of the left first gear **130** and the left second gear **132**, respectively corresponding to FIGS. **7**, **8** and **9**. As shown in FIG. **11**A, there is a backlash between two engaging teeth of the first and second gears **130** and **132**. When the second gear **132** is swung about the object optical axis OL as shown in FIG. **12**B and **12**C, the pitch circles **130**P and **132**P are intersect with each other on two points. In this state, the second gear **132** is swung within a range of the backlash, which allows the swinging of the second gear **132** about the object optical axis OL.

With such an arrangement, the interpupillary adjustment does not affect the rotation of the cam rings **110** and **120**.

It is preferred that the pitch circle diameter of the second gear **132** is smaller than that of the first gear **130**, so that a relatively large backlash can be provided between engaging teeth of the first and second gears **130** and **132**. It is alternatively possible that the pitch circle diameter of the second gear **132** is larger than that of the first gear **130**.

The arrangement in which the cam rings **110** and **120** move the lens groups is described. Since the left and right cam rings move the lens groups in a similar manner, the description will deal with the arrangement in which the left cam ring moves the lens groups.

As shown in FIG. **12**, the second lens **12**L and the third lens **15**L (FIG. **2**) are respectively supported in second and third lens frames **170** and **175**. The fourth lens **16**L is fixed to an eyepiece ring **180** which is mounted to the rear end of the swingable body **3**. The second and third lens frames **170** and **175** are respectively provided with pins **171** and **176**. The cam ring **110** has two cam grooves **112** and **113** for moving the second and third lens frames **170** and **175**. A guide ring **150** is provided in the cam ring **110**, which has linear guide grooves **152** and **153**. The guide ring **150** has flange portions **156** at the rear ends thereof, which engage recesses **322** formed at the rear end of the swingable body **3**, so that the guide ring **150** does not rotate with respect to the lens barrel **3**. The second lens frame **170** is inserted in the guide ring **150** so that the cam pin **171** is inserted through the cam groove **112** and the guide groove **152**. Similarly, the third lens frame **175** is inserted in the guide ring **150** so that the cam pin **176** is inserted through the cam groove **113** and the guide groove **153**. With such an arrangement, when the cam ring **110** is rotated, the second lens **12**L and the third lens **15**L are moved in the direction parallel to the object optical axis OL (FIG. **4**).

As constructed above, according to the binocular of the embodiment, the interpupillary adjustment does not cause unintentional rotation of the cam rings **110** and **120**. Thus, the magnifying-power is not unintentionally changed by the interpupillary adjustment.

The second embodiment of the invention is described with reference to FIG. **13**A, **13**B and **13**C. In the second embodiment, first and second rollers **230** and **232** are used instead of the first and second gears **130** and **132** of the first embodiment. Further, a contact member **211** is provided to the cam ring **110** (FIG. **12**) instead of the sector gear **111**. The second embodiment is same as the first embodiment, except for the first and second rollers **230** and **232** and the contact member **211**.

FIGS. **13**A, **13**B and **13**C show the relationship of the first and second rollers **230** and **232** and the contact member **211** when the interpupillary distance is intermediate, maximum and minimum. The first roller **230** contacts the second roller **232**, and the second roller **232** contacts the contact member **211**, thereby to transmit the rotation of the magnifying-power-varying knob **93** (FIG. **4**) to the cam ring **110** (FIG. **12**). The second roller **232** are made of an elastic material such as rubber. In the second embodiment, a contact point of the first and second transmission rollers **230** and **232** is located on the object optical axis OL as shown in FIG. **13**A.

In FIG. **13**A, a point A is defined on the second roller **232** so that the point A contacts the first roller **230** when the interpupillary distance is intermediate. Further, a point B is defined on the second roller **232** so that the point B is opposite to the point A with respect to the center of the second roller **232**. When the second roller **232** and the contact member **211** are swung about the swing axis (shown by the object optical axis OL) as shown in FIG. **13**B, it causes a deformation of the second roller **232**. In this states, since the above-defined point A corresponds to the swing axis, the point B (which is opposite to the point A) still contacts the contact member **211**. Thus, the relationship between the second roller **232** and the contact roller **211** in FIG. **13**B is same as that of FIG. **13**A. Similarly, when the second roller **232** and the contact member **211** are swung as shown in FIG. **13**C, the relationship between the second roller **232** and the contact member **211** is same as that of FIG. **13**A. Accordingly, the interpupillary adjustment does not cause the unintentional rotation of the cam rings.

It is preferred that the diameter of the second roller **232** is smaller than the diameter of the first roller **230**, so that the second roller can be deformed in a relatively large amount. It is alternatively possible that the diameter of the second roller **232** is larger than that of the first roller **230**.

As constructed above, according to the second embodiment, the magnifying-power is not unintentionally changed by the interpupillary adjustment.

Although the structure and operation of a binocular is described herein with respect to the preferred embodiments, many modifications and changes can be made without departing from the spirit and scope of the invention.

The present disclosure relates to subject matter contained in Japanese Patent Application No. HEI 09-29620 filed on

Jan. 29, 1997, which is expressly incorporated herein by reference in its entirety.

What is claimed is:

1. A binocular comprising:

two parallel telescope systems;

two swingable bodies respectively accommodating said telescope systems;

a supporting body which swingably supports said swingable bodies so that said swingable bodies are respectively swingable about two parallel swing axes, said swing axes defmed on said supporting body;

two drive rings rotatably provided to said swingable bodies;

an operation knob provided to said supporting body;

two rotating bodies respectively linked to, said drive rings, each of said rotating bodies located across a border of said swingable body and said supporting body; and

two middle bodies rotatably provided to said supporting body,

wherein each of said middle bodies is located between said operation knob and a respective one of said rotating bodies and engages with said respective one of said rotating bodies, and wherein an engaging position of each said middle body and each said rotating body is located on a respective one of said swing axes.

2. The binocular according to claim **1**, wherein each of said telescope systems has an object system and an eyepiece system, an eyepiece optical axis of said eyepiece system being parallel but off-centered with an object optical axis of a front-most lens of said object system.

3. The binocular according to claim **2**, wherein each said swing axes respectively corresponds to a respective one of said object optical axes.

4. The binocular according to claim **3**, each said swingable body including:

a front barrel accommodating said front-most lens;

a rear barrel accommodating at least said eyepiece system, said front and rear barrels being parallel but off-centered with each other; and

an intermediate barrel provided between said front and rear barrels.

5. The binocular according to claim **4**, wherein a respective one of said drive rings is provided in a respective one of said rear barrels.

6. The binocular according to claim **5**, wherein a respective one of said rotating bodies is provided to each said rear barrel so that said respective one of said rotating bodies projects from said rear barrel.

7. The binocular according to claim **6**, wherein each said intermediate barrel accommodates an erecting system.

8. The binocular according to claim **4**, said supporting body comprising:

a front support which supports said front barrels; and

a rear support which supports said intermediate barrels, said operation knob being provided to said rear support.

9. The binocular according to claim **1**, wherein each said rotating body includes a gear.

10. The binocular according to claim **9**, wherein a peripheral gear is provided to a periphery of each said drive ring, each said peripheral gear engaging with a respective one of said rotating bodies.

11. The binocular according to claim **1**, wherein each of said drive rings belong to a magnifying-power-varying mechanism which moves lens groups of said telescope systems along a respective axis parallel to said object optical axes.

12. A binocular comprising:

two parallel telescope systems;

two swingable bodies respectively accommodating said telescope systems;

a supporting body which swingably supports said swingable bodies so that said swingable bodies are respectively swingable about two parallel swing axes, said swing axes defined on said supporting body;

two drive rings respectively provided to said swingable bodies;

an operation knob provided to said supporting body;

two rotating bodies respectively linked to said drive rings, each of said rotating bodies located across a border of said swingable body and said supporting body;

two middle bodies rotatably provided to said supporting body, each of said middle bodies being located between said operation knob and a respective one of said rotating bodies and engaging with said respective one of said rotating bodies; and

wherein an engaging position of each said middle body and said respective one of said rotating bodies is located on said swing axis.

13. The binocular according to claim **12**, wherein each of said telescope systems has an object system and an eyepiece system, an eyepiece optical axis of said eyepiece system being parallel but off-centered with an object optical axis of a front-most lens of said object system, and

wherein each of said swing axes respectively corresponds to a respective one of said object optical axes.

14. The binocular according to claim **13**, each said swingable body including:

a front barrel accommodating said front-most lens;

a rear barrel accommodating at least said eyepiece system, said front and rear barrels being parallel but off-centered with each other; and

an intermediate barrel provided between said front and rear barrels.

15. The binocular according to claim **14**, wherein a respective one of said drive rings is provided in a respective one of said rear barrels.

16. The binocular according to claim **15**, wherein a respective one of said rotating bodies is provided to each said rear barrel so that said respective one of said rotating bodies projects from said rear barrel.

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